SPRINT CORPORATION
CINGULAR WIRELESS LLC

May 13, 2002

Mr. Donald Abelson, Chief
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Mr. Thomas J. Sugrue, Chief
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W.
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Mr. Edmond J. Thomas, Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: ***Written Ex Parte Communication***
Mobile Satellite Systems – Terrestrial Services
IB Docket No. 01-185; ET Docket No. 95-18

Dear Messrs. Abelson, Sugrue and Thomas:

Cingular Wireless LLC ("Cingular") and Sprint Corporation, on behalf of its wireless operating company, Sprint Spectrum L.P., d/b/a Sprint PCS ("Sprint"), submit the attached technical paper prepared by Telcordia Technologies ("Telcordia") regarding the pending request of certain mobile satellite service ("MSS") licensees for authority to provide cellular-based terrestrial services in the MSS spectrum band.[1]

This analysis and filing are in response to the Commission's Public Notice requesting a "detailed, technical discussion" regarding the technical feasibility of MSS segmentation.[2] Cingular and Sprint understand that they are submitting this technical analysis after the date the Commission specified. However, the parties were obviously unable to identify the deficiencies

[1] *See* Attachment A, Dr. Jay Padgett, Senior Research Scientist, Telcordia Technologies, "Analysis of Spectrum Sharing Between MSS and Terrestrial Wireless Services" (May 10, 2002)("Padgett Analysis").

[2] *See* Public Notice, *Commission Staff Invites Technical Comments on the Certain Proposals to Permit Flexibility in the Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band,* IB Docket No. 01-185, ET Docket No. 95-15, DA 02-554, at 2 (March 6, 2002)("Public Notice").

in the MSS filings until those papers were submitted, and Dr. Padgett of Telcordia thereafter needed time to prepare his analysis. Cingular and Sprint respectfully submit that Dr. Padgett's analysis will further the development of a meaningful record on this important issue, and urge the FCC to give this filing due consideration.

SUMMARY

The Telcordia analysis demonstrates that contrary to the claims of MSS proponents:

- It is technically feasible for separate operators to share the MSS band in the provision of satellite and terrestrial services, and
- There would be no loss of spectral efficiency if two different firms as opposed to one firm operate the satellite and terrestrial systems.

In fact, the legal ownership of the terrestrial base stations has no bearing on the technical feasibility or spectral efficiency of ATC networks.

More fundamentally, however, the Telcordia analysis shows that the central question before the Commission is not the technical feasibility of having a separate ATC operator, but the practical feasibility of doing any spectrum sharing between satellite and terrestrial networks. The analysis demonstrates that the satellite uplink can tolerate only a small number of active cochannel ATC handsets because of the total effective isotropic radiated power ("EIRP") radiated into the sky by the ATC terminals within the MSS beam.

ATC usage erodes the capacity of the satellite uplink, and even a moderate amount of ATC usage within the footprint of a satellite beam would consume all of the uplink capacity of the beam on the affected frequencies. Thus, the deployment of even modest ATC networks would pose a substantial risk of rendering the satellite incapable of providing MSS services, including in remote and rural areas. Indeed, even using all of the assumptions made by the two MSS licensees submitting technical analyses, "integrated" ATC operators could serve only a tiny number of ATC handsets before ATC interference would begin to materially degrade available capacity in their satellites:

- With cochannel (same frequency) sharing, ICO could serve at most 18 ATC handsets operating outdoors and transmitting at full power (100 milliwatts) per CDMA carrier pair within one of its satellite beams. With dynamic frequency assignment, ATC capacity is improved by 50 percent, to 27 outdoor ATC handsets per CDMA carrier pair per spot beam. One of ICO's spot beams can cover an area larger than the State of Alaska.

- Based on Globalstar's own calculations, Globalstar could serve between 17 and 34 ATC handsets operating outdoors per CDMA carrier pair within one of its satellite beams using dynamic frequency assignment. With cochannel sharing, service to only 80 outdoor ATC handsets within one of Globalstar's beam would render the beam incapable of providing any MSS services. One of Globalstar's spot beams can cover an area larger than the State of Texas.

Traffic volumes this small would not justify the construction and operation of ATC terrestrial networks. Accordingly, the only reasonable conclusion one can draw from the MSS ATC proposal is that MSS licensees do not intend to share spectrum between ATC and MSS use, but rather intend to separate the MSS band into two segments – one segment for ATC use and a separate segment for MSS use. Only through such a "hard segmentation" can an ATC operator avoid the severe capacity constraints discussed above and thereby justify economically the costs of constructing and operating terrestrial networks comparable to cellular/PCS networks. Because segmented spectrum dedicated to ATC would not be returned to MSS use,[3] the grant of ATC authority to MSS licensees would effectively result in a *de facto* reduction in the amount of MSS spectrum allocated to MSS services.

Sprint and Cingular submit that the subject of ATC thus requires the Commission to reassess the current allocation of spectrum to MSS. If too much spectrum has been allocated to MSS, as the facts seem to suggest, then the unneeded spectrum should be reallocated and auctioned because the Telcordia paper demonstrates that terrestrial networks using separated spectrum are dramatically more spectrally efficient than ATC networks sharing the MSS band. If, however, the Commission determines current MSS allocations are needed to support satellite services, then it should not permit any use of ATC networks, because of the considerable risk that ATC networks would pose to the capacity of MSS networks.

[3] Once the MSS band is segmented between ATC and MSS use, the spectrum allocated to ATC realistically would never be returned for MSS use because it is not rational to abandon ATC network investment or disconnect ATC users (especially when terrestrial networks with their much smaller cells are capable of serving more customers than an MSS system can serve).

BACKGROUND

MSS licensees have taken the position that it is not possible to share the MSS band between separate satellite and terrestrial systems. For example, ICO Global Communications ("ICO") told the Commission earlier this year that such a "sharing approach is technically infeasible":

> Consequently, any attempt by the Commission to authorize an independent terrestrial mobile service in the MSS spectrum would make it impossible for MSS networks to operate existing constellations or deploy new ones.[4]

In response, the Commission issued a Public Notice specifically requesting "a detailed, technical discussion" that addresses whether, from "a purely technical point of view," it is "technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band?"[5]

The submissions filed by MSS interests in response to the Commission's inquiry were disappointing. For example, ICO did not present a technical analysis, but it continued to claim that "[s]evering terrestrial operations from satellite operations in the 2 GHz MSS band would so seriously compromise MSS as to render it infeasible."[6] Globalstar similarly asserted that "ATC authority 'severed' from MSS licensees is not technically feasible."[7]

Globalstar submitted a technical analysis in response to the Public Notice, which concluded that it was possible to provide terrestrial-based services using the MSS band using "dynamic frequency assignment."[8] However, the Globalstar paper did *not* analyze the question that the Commission had posed – namely, whether it is technically feasible to have *separate* terres-

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[4] ICO Ex Parte at 1 (March 8, 2002), summarizing a March 5, 2002 FCC meeting. Unless otherwise noted, all ex parte submissions and pleadings cited in this letter were filed in IB Docket No. 01-185 and ET Docket No. 95-18.

[5] *See* Public Notice at 2.

[6] ICO Supplemental Comments at 1 (March 22, 2002). ICO did submit a seven-page technical analysis with its October 22, 2001 comments. *See* ICO Appendix A, "Benefit of Integrating MSS Satellite/Ancillary Terrestrial Components" ("ICO Analysis").

[7] Globalstar Response to FCC Public Notice at 4 (March 22, 2002).

[8] Globalstar, "Technical Comments on Certain Proposals to Permit Flexibility in the Delivery of Communications by Mobile Satellite Service Providers in L-Band, the 2 GHz Band and the 1.6/2.4 GHz Bands," at 25-31 (March 22, 2002)("Globalstar Analysis").

trial and satellite operators. Globalstar simply concluded without any analysis that it is "most appropriate for the MSS operator to coordinate the use of the frequencies used for ATC."[9]

Because of the deficiencies in the MSS submissions, Cingular and Sprint commissioned Dr. Jay Padgett, a Senior Research Scientist with Telcordia, to address the question that MSS parties chose not to address.[10] As demonstrated in the attached analysis and as summarized below, Dr. Padgett concludes that not only is it technically feasible to have separate operators, but also that there would be no loss of spectral efficiency if the satellite and terrestrial systems are operated by two independent firms as opposed to one firm.

More fundamentally, Dr. Padgett concludes that spectrum sharing between terrestrial and satellite systems, even with "dynamic frequency coordination" to prevent a terrestrial system from operating on the same frequency as an MSS beam within the footprint of that beam, is unsound from an engineering perspective. To avoid significant impact on the MSS system, the number of ATC terminals operating within the footprint of a MSS beam would need to be very limited.

MSS Parties Have Not Demonstrated That Dynamic Frequency Coordination Is Operationally Feasible

Globalstar and ICO propose use of "dynamic frequency assignment" ("DFA") as a means to share the MSS band between MSS services and ATC services. With DFA, the satellite beam and an ATC network within the beam footprint would not use the same frequency channels. As Globalstar explains:

> Basically, ATC receives its own block of spectrum in regions around ATC base stations. The MSS service will not use the same frequency channels that are assigned to the ATC service in the regions near ATC base stations. . . . Up to a

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[9] *Id.* at 43.

[10] Dr. Padgett's paper develops detailed mathematical models to represent the effects of interference between co-channel ATC and MSS systems on both the uplink and downlink. These models allow the capacity impact on one system due to interference from the other to be calculated; therefore the ATC/MSS capacity tradeoff can be quantified. The analysis indicates that the effects of downlink interference in both directions (ATC to MSS and the reverse), as well as the effect of uplink interference from MSS terminals to ATC base stations, are confined to areas near ATC-MSS coverage boundaries, and are likely manageable. This is not the case, however, for uplink interference to MSS from ATC terminals, which is the limiting factor with respect to the potential for spectrum sharing between ATC and MSS, even with coordinated operation and dynamic frequency assignment.

limit, the ATC terminal "uses" the capacity of the satellite channel even though the terminal is communicating with the ATC base station.[11]

Cingular and Sprint cannot comment on Globalstar's DFA proposal because Globalstar does not explain how it would implement DFA.[12] ICO states that it would implement DFA by using its proposed CDMA ATC network frequencies not utilized by the overhead spot beam at the time.[13] According to ICO, as MSS coverage from one spot beam is replaced by an adjacent beam using different frequency channels, ICO would adjust in "real time" the channels used by the ATC network to ensure that other channels were used.[14] Based on the data ICO submitted, it appears that the ATC network would be required to switch frequency channels every six to 15 minutes.[15]

Sprint is familiar with CDMA terrestrial networks of the sort ICO is proposing to use for its ATC network, and it does not believe that CDMA frequency channels (1.25 MHz CDMA carriers) can be changed in "real-time." The CDMA air interface is not designed for routine system-wide frequency switching. A change in frequency would require the CDMA handset to reacquire the pilot signal and other overhead channels and then to re-establish power control parameters. These processes could consume several seconds. Thus, persons using their ATC handsets at the time the ATC network changes frequencies would most likely lose their connections.

It is possible there are considerations in ICO's network that would mitigate this operational problem. However, based on the information that ICO has submitted in the record, it

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[11] Globalstar Analysis at § 2.1, p. 25. *See also* ICO Comments at 33 (Oct. 22, 2001)("[I]n any given beam, the ATC can operate on channels that are unavailable to the satellite network.").

[12] Globalstar uses CDMA for its MSS system and proposes use of CDMA for an ATC network. One way to implement DFA would be for Globalstar to assign to the ATC network 1.25 MHz CDMA carrier channels that it would not use with its MSS system, but then this capacity would no longer to available for any MSS service. It is thus unclear how Globalstar would implement DFA without reducing the capacity of the MSS services.

[13] One ICO spot beam appears to use 25% of available MSS spectrum capacity. *See* ICO Analysis at A-5 ("The ICO system reuses frequencies with a 4:1 beam pattern.").

[14] *See* ICO Analysis at A-2; ICO Comments at 34 (Oct. 22, 2001).

[15] ICO states that its beams range in diameter from 600 to 1,500 kilometers. *See* ICO Supplemental Comments at 7 (March 22, 2002). It further states that its beams move at about 100 kilometers per minute with respect to a stationary point on Earth. *See* ICO Comments, Appendix B, at B-1 (Oct. 22, 2001).

would appear that most ATC calls in progress would drop each time the ATC frequencies are changed (every six to 15 minutes).

SHARING THE MSS BAND BETWEEN SEPARATE TERRESTRIAL AND SATELLITE OPERATORS IS TECHNICALLY FEASIBLE

The principal question the Commission posed in its Public Notice is whether it is technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band. MSS interests have identified two possible ATC scenarios: (a) an ATC network that uses the same frequency channels as the satellite, and (b) an ATC network that uses different frequencies than the satellite spot beam. Dr. Padgett concludes that severing ATC operations in either scenario is "quite feasible."[16]

- The Cochannel (or Sharing the Same Frequency) Approach. MSS interests note that ATC handsets pose little or no interference problem to satellite capacity so long as the ATC handsets are active (in operation) in areas that are not in line-of-sight to the satellite.[17] MSS interests acknowledge, however, that due to the sensitivity of their satellite receivers to aggregate power emitted from outdoor active ATC handsets (with outdoor defined as being in line of sight to the satellite),[18] the number of outdoor ATC handsets must be limited.[19]

Globalstar and ICO have each provided various calculations of the maximum number of outdoor ATC handsets that could be used simultaneously within one of their spot beams without degrading the capacity of their satellites. According to Globalstar, if it built an ATC network

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[16] Padgett Analysis at 2.

[17] *See, e.g.,* ICO Supplemental Comments at 11 (March 22, 2002)("Blocked ATC UTs [User Terminals] . . . are effectively shadowed or 'blocked' from illuminating the MSS satellite. These ATC UTs could operate without excessive interference to co-frequency MSS UTs, since their signals will experience significant attenuation losses and will be received at levels much lower than unblocked MSS signals arriving the at the satellite in the same spot beam.").

[18] *See* ICO Analysis at A-2 ("An 'outdoor' handset means a handset with direct line-of-sight to the satellite.").

[19] *See, e.g.,* Globalstar Analysis at § 1.1.6, p. 7 ("[T]he aggregation of power from a number of terrestrial terminals could cause unacceptable interference to the MSS spacecraft receiver."); ICO Supplemental Comments at 6 (March 22, 2002)("Unblocked UTs operating in the 2 GHz MSS uplink produce signals intended for reception within the terrestrial system, but which also reach the MSS satellite at aggregate interference levels comparable to signals form MSS UTs. As a result, the unblocked UTs could interfere with co-frequency transmissions from MSS UTs to the satellite.").

using the cdma2000 air interface to accompany its CDMA satellite network, its ATC network could accommodate only one active cochannel outdoor handset operating at full power within each of its spot beams at minimum range (1414 km) to the satellite.[20] Globalstar estimates that considering such factors as the look angle from the spacecraft (which determines the distance from the handset to the satellite), it may as a practical matter be able to accommodate simultaneously up to eight active cochannel outdoor handsets within each of its spot beams.[21]

ICO performed a similar analysis for its proposed ATC system, which would also use cdma2000 (although its satellite system is designed to use FDMA/TDMA). ICO has determined that its ATC network could accommodate within each of its spot beams up to 18 cochannel outdoor ATC handsets operating simultaneously and at full power (100 milliwatts).[22] ICO estimates that considering such factors as speech activity and fading, its ATC network using the sharing method might accommodate up to 45 simultaneous active cochannel outdoor ATC handsets per CDMA carrier pair within each of its spot beams.[23]

This cochannel approach involves two networks that would operate independently from each other: an ATC network and a satellite network. As such, it is technically possible to have separate entities operate each network. To ensure that available satellite capacity is not degraded, rigorous emissions levels would have to be imposed on the uplink emissions of the entire ATC network (as opposed to the traditional approach of limiting emission levels from each individual handset). However, these emission limits would need to be enforced whether the ATC network is operated by the MSS licensee or by a different entity.

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[20] *See* Globalstar Analysis at § 1.1.6, p. 8 ("The threshold is only 1.4 dB greater than the interference produced by one ATC handset, thus, two handsets would violate this threshold."). Globalstar assumes that the allowable interference threshold is a six percent (6%) increase in the effective noise temperature at the satellite receiver. In Dr. Padgett's analysis, this translates to a 2% capacity reduction of the MSS uplink. *See* Padgett Analysis at 18.

[21] *See id.* ("Assuming the optimistic interference case, where all of the interfering handsets would be at the maximum range, the interference from nine ATC handsets would exceed the threshold.").

[22] *See* ICO Analysis at A-1 ("For an acceptable C/I of 12.8 dB, it can be concluded that the number N_0 of terrestrial handsets with the characteristics described above that could be simultaneously in use within an ICO beam is at most 18. For this number of users with the given characteristics, no excessive interference would be caused to a co-frequency signal in the SC (satellite component).").

[23] *See id.* at A-3 to A-4.

- The Dynamic Frequency Assignment (or Use of Different Frequencies) Approach.

Globalstar and ICO, recognizing the severe limitations of the cochannel sharing approach (both in coverage and capacity), propose use of "dynamic frequency assignment" ("DFA") to increase the allowable capacity of the ATC network. As discussed above, Globalstar and ICO use the phrase DFA to refer to the process whereby the ATC network and MSS network communicate in real time over a control channel to ensure that each network is using different frequency channels at the same time, within the footprint of a given MSS beam. The discussion below assumes the operational problems with CDMA and ATC networks using DFA identified above can be overcome.

While DFA will reduce the effect of ATC terminal interference to the MSS uplink, such an approach will not eliminate the interference.[24] ICO and Globalstar have analyzed this impact and determined the increase in the allowable number of ATC terminals per beam that can be realized using DFA, compared to the cochannel approach. ICO states that the use of a DFA process would result in a 50 percent net improvement in ATC capacity compared to the cochannel scenario discussed above.[25] Globalstar calculates that DFA would deliver nearly a four-fold increase in ATC network capacity, although Globalstar does not disclose any of the assumptions it made in reaching this conclusion.[26] However, Globalstar's creditors recently suggested that use of DFA would result in Globalstar realizing only a "fifty percent more efficient use of MSS spectrum."[27] In any event, it is clear from these results that even with DFA, the potential for true spectrum sharing between MSS and ATC networks is very limited due to the effect of the aggregate radiated ATC terminal power on the MSS uplink.

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[24] There are several reasons for this, as Dr. Padgett explains in his paper. *See* Padgett Analysis at 70-71.

[25] *See* ICO Analysis at A-6 to A-7 ("[S]imulations have indicated that a 50% net improvement in ATC capacity could be readily achievable without any impact on the SC capacity.").

[26] Globalstar states that an ATC network using the cochannel approach would accommodate between 30-270 indoor ATC handsets per spot beam. *See* Globalstar Analysis at 8. In contrast, with the dynamic frequency assignment approach, Globalstar states that an ATC network could accommodate between 500 and 1,000 ATC users. *See id.* at 26.

[27] Globalstar's Official Creditors Committee Ex Parte at 14 (May 9, 2002). Cingular and Sprint cannot assess the various Globalstar claims – spectrum efficiency improvement ranging from 50% to 300% – because the assumptions and calculations have not been disclosed.

Globalstar and ICO each assert that only an integrated MSS-ATC network can use DFA.[28] A careful review of their papers, however, reveals that they never explain why separate MSS and ATC operators could not also engage in DFA, using the same control mechanisms that would be used by an "integrated" operator.

Globalstar does not describe how it would perform DFA if it operated an ATC network. ICO states that it would use a Spectrum Sharing Manager ("SSM"), basically a network controller that would "shift frequencies between the SC [satellite component] and ATC."[29] The SSM would base its calculations on such factors as the ATC system coordinates, spacecraft locations, trajectories, and beam frequency usage. Once the appropriate frequency use calculations were made, they would be downloaded to terrestrial network components (*e.g.,* ATC base stations).

The information (frequency use instructions) that an integrated MSS-ATC operator would generate is the same information that would make feasible the use of separate MSS and ATC operators. Dr. Padgett concludes that it is technically feasible for separate MSS and ATC operators to engage in the dynamic frequency assignment process, and he identifies three different ways in which the MSS network and ATC network could share pertinent information.[30] He notes that the "control information itself would be a fairly small block of data instructing the ATC network on the frequencies available for ATC use in the near term."[31] Again, the identity of the legal owner of the ATC base stations has no bearing on the technical feasibility of engaging in dynamic frequency assignment.

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In summary, to respond to the Commission's specific question, it is technically feasible for one operator to provide terrestrial services and another operator to provide satellite services

[28] *See, e.g.,* Globalstar Response at 5 (March 22, 2002)("There is absolutely no chance that two different operators of two separate mobile systems could successfully accomplish such coordination."); ICO Supplemental Comments at 6 (March 22, 2002)("Only an ATC-integrated 2 GHz MSS operator can dynamically manage co-frequency satellite and terrestrial operations."); ICO Comments at 34 (Oct. 22, 2001) ("Real-time adjustment of the amount of spectrum assigned to each network would be out of the question because of the independence of the operators.").

[29] ICO Comments, Appendix B at B-5 (Oct. 22, 2002).

[30] *See* Padgett Analysis at 77-79.

[31] *Id.* at 78.

in the same MSS band – regardless of the specific ATC approach utilized (and assuming the DFA method is operationally viable).

THERE WOULD BE NO LOSS IN SPECTRAL EFFICIENCY BY HAVING SEPARATE TERRESTRIAL/SATELLITE OPERATORS

Globalstar and ICO alternatively assert that an "integrated" ATC operator would be more efficient (serve more ATC handsets) than would a separate ATC operator. There is no merit to these assertions. The laws of physics define spectral efficiency, not the legal ownership of various network components.

Globalstar would give the Commission the impression that an integrated ATC operator would be far more efficient compared to a separate ATC operator:

> In the forward band sharing operation, a fairly small number of "uncoordinated" ATC handsets (tens to hundreds) within a Globalstar satellite return link (L-band) beam can produce unacceptable interference to the MSS spacecraft receiver. However, when coordinated (i.e., the MSS operator is also operating the ATC service), the number of ATC handsets can be between 500 and 1000.[32]

Globalstar is making an "apples-to-oranges" comparison: it is comparing the efficiency of an ATC network using the cochannel approach with an ATC network using dynamic frequency assignment. As noted above, independent ATC operators can implement either ATC approach on the same basis as a MSS licensee.

ICO also asserts that an integrated MSS-ATC operator can "accommodate more terrestrial use of the spectrum than if the two components of the network were operated independently," claiming that an "integrated" operator would "improve spectrum utilization by 84% with respect to the independent operator."[33] This increased efficiency, ICO says, would be due to the "possibility" that an integrated operator can "assum[e] average conditions, as opposed to the worse-case conditions that an independent operator is forced to assume":

> The difference is that an integrated operator, having knowledge of all activity on the network, would be justified designing for the average benefit because it will be able to make adjustments in real time to accommodate the statistical variations.

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[32] Globalstar Analysis at 25-26. Globalstar's estimate that it could serve between 500 to 1,000 ATC handsets within each spot beam represents the total number of ATC handsets it thinks it could serve (indoor and outdoor) before degrading MSS capacity.

[33] ICO Analysis at A-1 and A-4.

> The independent operator, however, would have to design for worst-case conditions.[34]

ICO is thus also making an "apples-to-oranges" comparison.[35] As importantly, ICO's assertion – "real-time" adjustments to accommodate "statistical variations" will result in an 84% increase in capacity – does not appear to be credible.[36] But again, even if these "real time" adjustments could be made, the adjustments do not require that an ATC network be operated only by the MSS licensee.

ATC POSES A REAL RISK TO THE AVAILABILITY OF MSS SERVICE IN RURAL AREAS

MSS interests have asserted that their provision of ATC "will improve service to rural areas."[37] In fact, ICO has claimed that meeting demand in urban areas through integrated ATCs "will actually ensure that adequate satellite capacity remains available for rural applications":

> [A] single beam covers a very large area on the ground, and the amount of capacity available in a single beam is finite. Hence, in a satellite-only network, every transmission from a subscriber in New York City uses up capacity that would otherwise be available for a subscriber in Albany, or the Adirondacks, and *vice versa*. . . . By keeping portions of the traffic from densely populated areas off of the satellites, the ATC segment will leave more satellite capacity available for rural use than if the urban users were all routed through the satellite component of the MSS network.[38]

The Public Notice asked how ATC networks would affect service to remote and rural areas.[39]

Globalstar and ICO have calculated the maximum number of outdoor ATC handsets that could be operated simultaneously before the resulting interference would begin to reduce the capacity of their satellites. Based on the data it submitted, Globalstar calculates that it could toler-

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[34] *Id.* A-1 and A-2.

[35] Specifically, ICO compares an arrangement where there is no coordination between the two networks with an arrangement where "statistical variation" information (*e.g.*, building blockage) is exchanged. Since, as demonstrated above, it is technically feasible to exchange DFA data between two operators, it necessarily follows that it is also possible for two operators to exchange "statistical variation" information.

[36] *See* Padgett Analysis at 72 n.12.

[37] ICO Letter at 14 (March 8, 2001).

[38] ICO Comments at 24-25 (Oct. 22, 2001).

[39] *See* Public Notice at 2.

ate simultaneously between 17 to 34 outdoor ATC handsets, depending on the range to the spacecraft, within each of its spot beams.[40] One of Globalstar's spot beams covers an area larger than the State of Texas.[41] Thus, according to Globalstar's own calculations, it could not serve 35 handsets operating outdoors in the State of Texas without beginning to degrade the capacity of its satellite (*i.e.,* inhibit its ability to serve remote and rural areas).

Globalstar did not identify the number of outdoor active ATC handsets that would consume the entire MSS uplink capacity, thereby disabling the satellite beam from providing MSS services. Dr. Padgett has calculated that each ATC handset operating outdoors (unblocked to the satellite) and transmitting at full power (100 milliwatts) would reduce the capacity of Globalstar's CDMA MSS uplink beam by about 1.25 percent.[42] Accordingly, 80 such handsets within the beam footprint on a single uplink channel will reduce the capacity of the satellite beam to zero for that channel. To confirm, the simultaneous use of only 80 outdoor handsets on a given frequency within one of Globalstar's beams – covering an area larger than the State of Texas – would render the beam incapable of supporting satellite services, including service to remote and rural areas on the affected frequency.

ICO proposes somewhat different network architecture than Globalstar. Like Globalstar, ICO proposes to use cdma2000 for an ATC network, but its satellite system is designed to use FDMA/TDMA. ICO estimates that it could serve up to 45 cochannel outdoor customers per CDMA carrier pair within each beam.[43] Serving 46 outdoor handsets would render its beam incapable of supporting MSS services using the 2.5 MHz being used by the ATC network.[44] Thus,

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[40] Globalstar states it could serve between 500 and 100 ATC handsets within each of its spot beams. *See id.* These figures, however, assume indoor use of ATC handsets, with a 15-dB excess loss to the satellite (a factor of roughly 30 in terms of power). If these numbers are adjusted to reflect outdoor usage without blockage to the satellite, the ATC network it is proposing to construct could serve 17 to 34 ATC outdoor handsets within each Globalstar spot beam. *See* Padgett Analysis at 72.

[41] The State of Texas encompasses 261,914 square miles. It appears that one of Globalstar's spot beams covers 785,400 square kilometers – or 303,244 square miles – assuming a satellite coverage radius of 2000 km and 16 beams per satellite.

[42] *See* Padgett Analysis at 27, Figure 12. Dr. Padgett assumed the handsets were operating at full power (100 mW continuously). 9 dBW is about 8 watts, which corresponds to 80 handsets at 0.1 watts/handset.

[43] *See* ICO Analysis at A-4.

[44] As a point of comparison, Sprint's second generation (IS-95) CDMA network is capable of handling, on average 39 simultaneous users per cell site/base station per CDMA carrier channel (13 users per sec-

use of only 46 outdoor ATC handsets in an area of the size of Alaska would render its satellite incapable of providing MSS services using the MSS channels utilized by the ATC network.[45]

Globalstar and ICO submit optimistic customer forecasts for their proposed ATC networks. For example, ICO asserts that it could serve "without any impact to the satellite capacity approximately 1.6 million [ATC] subscribers in 15 MHz."[46] This statement is erroneous because even assuming the accuracy of ICO's 1.6 million forecast, the CDMA system it describes would require 30 MHz of spectrum – not 15 MHz.[47] ICO's 1.6 million forecast also contains several assumptions that are subject to question:

- No more than 2.5 percent of ATC customers would use their ATC service at the same time; and
- No more than 10 percent of all ATC usage would occur outdoors, within sight of the satellite, and indoor handsets (the other 90 percent) would be completely blocked from the satellite and contribute nothing to the interference.[48]

Service providers cannot control when and where their customers will use their service.[49] Given that only a small number of active outdoor ATC handsets within a spot beam area would disable the satellite from providing MSS services, Cingular and Sprint cannot agree with the

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tor, with three sectors per cell). Sprint is expecting that the voice capacity of its 2G CDMA network will nearly double when it activates its cdma2000 (1x) network.

[45] The State of Alaska encompasses 570,374 square miles. ICO states that its spot beams have diameters up to 1,500 kilometers, which translates to an area of about 682,000 square miles. *See* ICO Supplemental Comments at 7 (March 22, 2002).

[46] ICO Comments at 34 (Oct. 22, 2001).

[47] ICO's assertion that it could serve 1.6 million customers with 15 MHz of spectrum is predicated on the assumption that "10 channels of 1.25 MHz [CDMA carriers] can be accommodated in this spectrum," and it is clear from the context that ICO's analysis considered ten uplink CDMA carrier channels. *See* ICO Analysis at A-4. However, CDMA requires a separate 1.25 MHz carrier for both the uplink and the downlink. Thus, even assuming that ICO's 1.6 million customer estimate was valid, ICO would require ten CDMA carrier *pairs* – or 30 MHz of spectrum (vs. the 15 MHz claimed). *See* Padgett Analysis at 72.

[48] *See* ICO Analysis at A-3 and A-5.

[49] In this regard, ICO has acknowledged that if demand for ATC services exceeds the supply of non-overlapping channels, it will become "necessary" to assign them "overlapping channels" – namely, channels that would no longer be available for MSS. *See* ICO Letter, Appendix B at 19 (March 8, 2001).

MSS assertion that ATC "will improve service to rural areas" and "will actually ensure that adequate satellite capacity remains available for rural applications."[50]

THE COMMISSION SHOULD REALLOCATE AND AUCTION THE SPECTRUM THE MSS LICENSEES EFFECTIVELY ADMIT THEY DO NOT NEED FOR MSS SERVICE

The sharing of the MSS band between satellite and terrestrial operations, while technically feasible, is not practically viable. The foregoing discussion makes clear that ATC usage would have to be severely limited to ensure that satellite capacity is not materially degraded. As a practical matter, no one could economically build such an ATC network to serve an ATC customer base so small.[51]

Accordingly, the only reasonable conclusion one can draw from the MSS ATC proposal is that MSS licensees do not intend to share spectrum between ATC and MSS use. As a practical matter, the only way that the construction of an ATC network could be cost-justified would be to separate the MSS band into two different segments – one segment for ATC use and the other segment for MSS use. If, however, MSS licensees are willing to reduce the amount of spectrum devoted to MSS service, they have effectively acknowledged that they have access to more MSS spectrum than they need to meet the demand for MSS services.[52]

There is considerable demand for additional spectrum, including for terrestrial 3G advanced services and for possible relocation of government use of the 1710-1850 band. If too much spectrum has been allocated to MSS, as the facts suggest,[53] then the Commission should reallocate and auction the spectrum not needed for MSS. ATC should not, however, be permit-

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[50] *See* notes 37 and 38 *supra.*

[51] It might be possible for an existing terrestrial operator with existing infrastructure to operate a limited ATC network.

[52] As noted above, once the MSS band is segmented between ATC and MSS use, the spectrum allocated to ATC realistically would never be returned for MSS use because it is not rational to abandon ATC network investment or disconnect ATC users.

[53] For example, Globalstar recently advised the Commission that the total usage of its Big LEO system last year averaged only 65,400 minutes of use a day. *See* Globalstar Ex Parte, Attachment at 4 (March 13, 2002). Globalstar did not indicate whether this usage involved U.S. traffic only or all traffic throughout the world. Either way, this usage represents a gross underutilization of the 33 MHz of spectrum Globalstar has access to in the Big LEO band (and ignoring the additional 7 MHz it obtained in the 2 GHz MSS band). *See also* Globalstar's Official Creditors Committee Ex Parte at 5 (May 9, 2002)("Globalstar's spectrum currently is drastically underutilized").

ted in the spectrum needed to meet current and projected future MSS capacity needs, because of the substantial likelihood that ATC networks would degrade or eliminate satellite capacity.

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In summary, it is technically feasible to have a separate ATC operator share MSS frequencies. Cingular and Sprint submit, however, that the real issue before the Commission is not the technical feasibility of having separate operators, but the wisdom of permitting any terrestrial use of MSS spectrum, given the demonstrated likelihood that ATC usage will compromise the provision of MSS services. On the other hand, if too much spectrum has been allocated to MSS, spectral efficiency considerations dictate that the Commission reallocate the unneeded spectrum for terrestrial or other uses.

Pursuant to Section 1.1206(b)(1) of the Commission's rules, one copy of this letter is being filed electronically with the Secretary's office for filing in IB Docket No. 01-185 and ET Docket No. 95-18.

Respectfully submitted,

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Attachment

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